SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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MINING BY MACHINERY.

Although upwards of half-a-century has elapsed since the first substitution of machinery for manual labour in the working of rocks, we have still to look forward to the invention of really efficient machinery for the purpose. At the recent meeting of the "Institution of Engineers in Scotland," a highly interesting paper on "Tunnelling and Coal-Cutting Machinery" was read by Mr. John Downie, who remarked that the application of machinery in one form or another has now become universal in almost every branch of industry, but only within the last few years has there been any decisively marked advances made in the application of mechanical power as a substitute for manual labour in the extraction of the mineral wealth which may be truly said to be the very basis of our nation's greatness. He would divide the subject into two principal heads—Tunnelling and Coal-getting—incidentally touching on the other applications in illustration of the drawings, and speak on all of them in a general way, sufficient, he hoped, to elicit, in the after discussion that may follow on the merits and demerits of the various machines, some valuable information from those who best know these matters practically. He would simply make a selection of only a few machines, for sake of comparison, as it would take up too much valuable time to go over *seriatim* the eighty-three or more British patented appliances for mining (exclusive of all foreign inventions for similar purposes) that have been brought out since 1792 till the end of 1864. The salient features only of each invention would be rapidly described, premising always that this class of machinery, having been comparatively recently introduced into *general* use, it may, therefore, be considered as still *in its infancy*, and that very much has yet to be learnt about it ere it can be perfected.

The first of the Tunnelling Machines noticed was the celebrated one at present engaged in boring the Mont Cenis Tunnel, invented by M. Sommelier, and manufactured by the Société John Cockerell, at Serain. This machine has been already described, and much interesting information given as to its performance, in a paper read by Mr. Thomas Sopwith, jun., before the Institution of Civil Engineers last session, and published in the *Mining Journal* of February 20, 1864.

It may be well at this stage to add that credit is claimed for Mr. Thomas Bartlett, C.E., a gentleman connected with the well-known house of Brassey and Co., as being the *first* inventor of a mechanical jumper for rock, and which has become the starting point of whatever has been since achieved at Mont Cenis. As he had not seen any published account of this gentleman's plans, he could not speak definitely on the subject; but possibly some others might be able to supply the information, and, if so, give to our countryman the honour due for so important an invention.

Schwartzkopf and Philippsohn's Machines are, he believed, in use in the Swedish mines, and consist of a column carrying a jib, which is raised or lowered by a pinion working in a rack. The boring cylinder, with piston, is the same as in an ordinary steam-engine; the valve is conical and circular, and is turned by a spiral groove in cross-head of piston-rod. This cylinder is traversed along a single frame by means of a screw by an attendant (according as the boring proceeds), exactly in the same manner and design as an ordinary slide-rest of a lathe. The rest or frame, with cylinder, is carried by the jib; the boring tool is loosely held in the end of cylinder frame, and is turned by a rachet, the pawl of which receives the same motion as the circular valve, being worked off the valve spindle; the boring tool, unlike the Mont Cenis one, receives its blows from the end of piston-rod; and, to allow the *débris* to get clear out of the hole (in consequence of the tool not reciprocating), the tool has to be made of a spiral form, like a wood auger, to allow the *débris* to wind out; when set to work, the column is jammed fast by clamps betwixt the top and bottom of adit in the desired position. The piston makes from 1,200 to 1,400 strokes per minute, and bores Norwegian granite at the rate of 1¼ inch to 1½ inch per minute.

Captain Penrice's Tunnelling Machine is a powerful and colossal machine, and consists of a large face-plate (the diameter of the tunnel to be bored), with several rows of some hundreds of steel chisels across its diameter. The face-plate is mounted on a massive axle, working in bearings, at the end of which is the piston, working in a central cylinder, and has a large and small area, the same as in the Mont Cenis cylinder. The valve is an ordinary slide one, worked from a pair of donkey engines, which latter also propel the carriage containing the boring machinery, boiler, &c., by means of worm-wheels, and worm geared into the rollers, carrying the whole machine. The face-plate also gets its rotary motion by a worm-wheel affixed on the axle, into which a worm gears, and is worked by one of the above donkey engines. The operation may thus be described: The face-plate, with its numerous chisels, receives its reciprocation from the above central cylinder. After each blow it is turned slightly round, at the rate of 2½ revolutions per minute. The entire face or heading of tunnel surface is thus struck or tritured into small fragments or particles, which, upon falling down, are caught by an endless creeper, worked from a third donkey engine, which conveys the *débris* underneath its entire length, and delivers it at back of machine. It may be here mentioned that this machine would only do for soft stone; and the immense number of chisels take considerable time to take out and replace when they require sharpening. He believes this machine was tried in the Malvern Tunnel, on the Worcester and Hereford Railway, and also in the red sandstone in the neighbourhood of Newcastle-upon-Tyne, and was exhibited at work before the members of the British Association.

Crease's Machine, of which there are several modifications, in its principal features is the same as that of Schwartzkopf and Philippsohn, the first being made to strike the tool; but latterly they are constructed to reciprocate with the piston; and a recent patent shows that the valve is a steam-moved one, similar to Joy's or Colburn's valves. As the machine is so very similar to Schwartzkopf and Philippsohn's, it will be unnecessary to describe it here. He believes one of them was very much improved by Greene, and is at work at the Vigra and Clogau gold mine.

The Machine proposed by Gay, of Paris, consists of a cylinder the diameter of the tunnel, or say 6 feet 8 inches diameter by 2 feet 4 inches deep, and say 1½ inch thick; and round the front edge are fixed steel chisels at intervals for soft stone, prisms of flint agate, &c., for ordinary rock, and prisms of diamond for very hard rock. It is carried on an axle working in suitable bearings: and this axle carries a central boring tool. The cylinder and central tool receive a rotary motion from a belt or wire-rope, worked from a steam or air-engine, working in a pulley on a cross shaft, which gears into the axle by a pair of bevil-wheels—thus making a circular trench and a central hole. A rope is attached to the end of axle, and passed over a pulley, at the end of which is a heavy weight, for the purpose of keeping the cylinder and central tool steadily pressed against the rock whilst boring. Upon the necessary depth being attained, the machine is withdrawn, and another is placed to widen the bottom of the central hole, in order to make a powder-chamber; which, upon being blasted, will displace the whole mass out to the depth of the circular trench. He understands this machine works very well and rapidly, but is not aware where it is working. He has heard that a machine of a similar kind was, in the year 1852, made in Boston or New York, America, and worked, it is said, at the Hoosic Tunnel. It was designed for cutting a circle 24 feet diameter, but has no note of its performance.

Vallauri and Buquet's Machine (made by Cail & Co., of Paris, the celebrated engineers) is composed of two carriages—the lower one being mounted on six wheels, and the other is placed on the top of lower carriage, along which it slides in two V grooves, after the manner of the table of a planing-machine. At the end of the top carriage is a cross axle, carrying four quarters of a circle—one on each side, and the other two intermediate. The diameter of the quarter circles when revolving is nearly the height of the tunnel: on the periphery of each quarter circle are steel points, placed at intervals, and so set spirally that each cuts its own portion of a groove in the rock. These quarter circles are caused to revolve vertically by a wire-rope, worked from a portable engine outside the tunnel, after this manner. The portable engine works a cross shaft by two belts, and the wire-rope is placed once round a pulley on the said cross shaft and round the driving pulley on the machine, and the other end passes round an anchor tender, which latter runs on rails outside the tunnel, keeping the rope at one uniform tightness: and as the machine advances the tender will also advance. The driving pulley gears into a counter shaft, from which a chain drives the axle carrying the above quarter circles; thus cutting four vertical trenches from top of tunnel nearly to the bottom; the top carriage being advanced by a screw and hand wheel, actuated by an attendant. The lower carriage is mounted on eccentric wheels, and is occasionally turned down to the lowest point of eccentric, so that the circle may cut the trenches quite to the bottom of tunnel. He believes this machine has been at work in the Pyrenees and Carrara; and one claim the inventors put forward is, that this method does *not* require the employment of powder; another is, that the high speed of driving rope keeps up an excellent ventilation, and by working two machines alternately the system allows of the removal of the *débris* without interrupting the progress of the work.

De La Haye's Machine consists of two frames, adjustable as to height or length, which are secured between the top and bottom of shaft or adit. These frames carry a horizontal carriage for tool, which is caused to reciprocate and cut a trench after the manner of a plane: the raising or lowering of such, according as it executes the work, is done by an attendant. This machine is also adapted for cutting in a vertical direction; but he is not aware as to what power is employed to work such carriage.

The principal features of Freeby's Machine are—A number of spindles carrying the tools (say eight or more) are carried in a cast-iron frame, which slides along a lower frame mounted on wheels, and so arranged that it can be set at an angle, slightly vertical, or horizontal, across each and midway of the spindles, one of which is driven by a belt which drives all the others by intermediate cog gearing. On each of the cross shafts is a revolving cam, which strikes a 7-toothed circular cam on each of the longitudinal or tool spindles, which partly turns and presses them against a spiral spring, and so soon as the revolving cam slips clear, the spiral springs cause the tools to strike.

Sax's Machine is, he believes, somewhat like that of Schwartzkopf and Philippson, and works successfully in a tunnel near Aix-la-Chapelle; but in the absence of information or details, he is unable to describe it.

Munro and Scott's Machine consists of circular cutters, which reciprocate a part of a circle, and are worked from a circular steam chamber, in which a piston also works partly in a circle. The steam chamber with circular cutters is traversed up and down in a frame, and from side to side, cutting a trench around the tunnel.

Westmacott's Machine, introduced by Mr. Sopwith at Mr. Beaumont's mines in Allenheads, is worked by water pressure, and strikes the tool same as Schwartzkopf and Philippson's, but with what results he is unable to say, and also to describe the machine. He read recently, in a short account of it, that it worked satisfactorily, but some trouble was experienced in keeping the holes clear of *débris*.

Machines of the class applicable to Coal-cutting have been proposed for sawing or trenching by rotating cutters, by cutters fixed on an endless chain, by drilling, and by jumpers, paring by traversing tools, and "hewing" or "kirving" by means of a traversing pick fixed in a vibrating lever, and actuated by engine-power, or otherwise. Of these he would only notice, in a very brief way, a few of the most recent appliances.

Frith and Donnisthorpe's Machine was first introduced at the West Ardsley Colliery, near Leeds. There are two machines of this class at work at Hetton Main Colliery, and one at the Marchioness of Londonderry's Colliery, both near Durham. It is worked by compressed air of say 50lb. or so per square inch, acting on a reciprocating piston, at the rate of about 90 to 100 blows per minute, and giving motion to a heavy pick which cuts a horizontal groove, on the "long-wall" system, of from 2 to 4 inches wide (instead of 10 or 12 in. by the usual "hand kirving") by about 3 feet deep and about 100 yards in length of "benk" in about eight working hours. The attendant with one hand manages the valve which gives the stroke to the pick, and with the other moves the machine along. The return stroke is given by the engine automatically. He has no reliable data as to the comparative cost of coal-getting by this machine; but doubts not, as the extension of this system of mining proceeds, the working charges will be much reduced, as one set of air-compressors, and their other plant, may be sufficient to supply many machines at a much reduced outlay for attendant labour, &c.

Ridley's Machine is very similar in its action to the one just described, and the general description, as per circular, gives as a day's work (of 3 shifts of 8 hours each, or 24 hours for one machine) the "kirving's or under-cutting 200 to 300 yards of long wall face to a depth of 3 feet. This rate includes all necessary stoppages, and changing the machine from one "benk" to another.

The average speed of pick is from 65 to 80 blows per minute, and the rate of advance after each blow about one inch, the depth of cut being about 2 feet in the first, and 12 to 14 inches in the second cutting. This gives an average speed of traverse of nearly 1 foot lineal per minute for this machine, when all is in first-class order. The length of this machine is 40 inches, and it is specially adapted to seams of 2 feet thick and upwards. Its weight is about half-a-ton, and cost about 70*l.*, with one penny per ton royalty. Two of these machines are at work at the Earl of Durham's New Bottle Colliery; two at the Broomhill Colliery, Acklington, Northumberland; one at Suydle Colliery, Pontefract, Northumberland; and several others in Yorkshire, Lancashire, and Scotland. He has no note of their performance from any of the places where they have been at work.

Jones's Machine has a trunk cylinder (though this is not an essential part of the design), and a very simple and ingenious method of turning the pick to any angle from horizontal to vertical, and to either side, by means of a worm working into a wheel cast or fitted on the rocking-shaft bearing, and thereby carrying round the trunk and whole apparatus in the desired direction. The cylinder also is made to move longitudinally on the carriage, so as to adjust the blow of the pick to any point that may be necessary. The valve is worked by the piston in its back stroke striking against a rod, which passes through the back end of cylinder and actuates a lever connected with valve-spindle, having an elastic pad of India-rubber introduced in lever, to take away part of the concussion. The forward motion is by a hand-wheel and gearing like the others. These machines are at work at the High Royd, The Oaks, and the Wharncliffe Silkstone Collieries, in the neighbourhood of Barnsley, and several are expected to be at work in about a month or so at some of the collieries in Merionethshire. Their performance is said to be from ten to fifteen yards per hour, three feet under, and cost about 70*l.* each, exclusive of royalty.

Carret's Machine is actuated by hydraulic pressure on a piston having a sort of pairing-tool attached thereto, and differs from the others already described in the substitution of dead pressure for impact by percussive blows.

Nisbet's Machine is the invention of a gentleman whose long experience in colliery mechanics should enable him to have sound views on this subject. It is one of the most recent applications for this purpose, and differs from all others in these two points: First, the piston-rod is *not* coupled up direct to the vibrating lever actuating the pick, but to a crank-shaft, as in an ordinary engine, from which a second crank, with its connecting-rod capable of adjustment as to length, so as to influence the position in which the pick will deliver its blow, thus rendering it highly effective, seeing at the moment of impact the piston is then traversing at its greatest velocity, consequently, at the most effective part of its stroke; and this action is further intensified by the momentum of a fly-wheel. The shock or strain on the working parts of this machine is said to be more equally distributed than in others of similar construction. The second point is the self-acting traversing action along the face of the working. It is effected by means of worm and wheel gear driving a pinion working into a rack on the rail; the first motion being taken from the crank shaft by a wyper acting on a star-wheel capable of being easily thrown out of and into gear.

Having thus given a brief notice of these different Boring and Coal-Cutting Machines—sufficient he trusted to open up a discussion on their several merits, and on that class of machinery generally—he would now return to the main subject of the paper, and describe Mr. Low's machinery for these purposes.

The chief peculiarities of the *first* boring cylinder which Mr. Low constructed, before the present kind, and which, with its tool, is but 4 feet 9 inches long, are, that the cylinder is stationary (unlike all others in which the cylinder moves), the tool being telescopic, and is propelled from the piston (by a screw which goes up inside the piston-rod) in the progress of boring, and is actuated by a diagonal slot attached to the cylinder by a roller rachet-wheel. The screw, therefore, receives the blows centrally, thus obviating the danger of the tool leaning to either side. Although provision is made that the tool travels at four different rates, proportionate to the hardness of the rock, this being regulated by the position of the diagonal propelling slot, which can be placed with a greater or less slope, so as to actuate either one, two, three, or four teeth, and thus to move the screw with tool more or less quickly, it required too much attention; and this, coupled with the crystallization and gradual loosening of the screw and other parts, induced Mr. Low to construct one to do away with screws and gearing altogether, and to propel self-acting, according to the rate that the tool is then cutting, and which Mr. Low has accomplished, and according to recent trials, granite was bored by it at the rate of 14½ inches in seven minutes, and 3 inches in 55 seconds; and the average rate at which it bores the rock at the Dublin Corporation Waterworks Tunnel, Roundwood (which is excessively hard, so much so that the miners have sometimes used from 24 to 36 tools to complete one hole 24 inches deep) composed of green hornblende interspersed with white quartz veins, is one inch per minute. The advancement of the tool as it bores requires no attention, and Mr. Low has considered it best also to do away with the turning motion, and effect the same by hand, as the very great rapidity of the blows is rather severe upon the turning motion. I may here mention that they can bore quicker, and keep the edge on tool better, by striking less hard, and to make up for not cutting so deep, the blows have been increased from 250 to 500 or 600 blows per minute; consequently the result is that they have been enabled to bore one hole with two tools without sharpening, instead of using five or six as formerly, and with *one* tool a hole 26 inches deep has been bored in the Roundwood granite without sharpening.

The average rate at which the machine bores the excessive hard rock at Roundwood is one inch per minute. A hollow tool has been tried, into which was inserted a water jet, and also having the exhaust from the cylinder turned into it, which forced the water at a considerable pressure out at the point of tool in the hole. This was found a most excellent plan for keeping the hole clean; but in consequence of its complication it was abandoned for a separate water jet.

The New Boring Cylinder Machine is only 4 feet 9 inches long, and the working cylinder, constructed of brass, is placed inside another cylinder of wrought-iron, in which it is free to move from one end to another, and also to rotate. The back end of the cylinder is packed with india-rubber, metallic, or other suitable rings, so as to be air or steam tight. The front end fits into a wrought-iron cross-head (in which it is free to revolve). This cross-head is slotted on each side to fit into two slide-bars (carried from cylinder to end bearing of machine), along which it slides as the brass cylinder is moved along inside the iron

cylinder in the process of boring. The sides of the above-named cross-head, where it fits into the slide-bars, is projected in front on each side of the slide-bars, between which is placed two cam-bars, partly forked on each edge of slide-bars. The other end of the said cam-bars rests in notches cut at intervals of 1½ inches from each other on the inner side of the slide-bars, and are constantly kept pressed against the bottom of the said notches by two spiral springs of steel wire. The other ends of the cam-bars, which work on centres, are so curved towards each other that the end of piston-rod may strike them at the proper time. The operation may thus be explained :—The air, steam, or other motive fluid is admitted by the pipe (which leads from one of the trunnions) into the wrought-iron cylinder, behind the back end of the working cylinder, and thus keeps it pressed outwards against the cross-head, which is kept in its place, or from going forward by the two cam-bars, each of which rests against one of the notches in the slide-bars. It will thus be seen that when the tool has advanced 1½ inches into the hole, the end of piston-rod (the end of which is allowed to go 1½" beyond its limit) comes into contact with the cams or curved end of cam-bars, and thus causes them to slip over the notch into the next, and this is repeated for every 1½ inch bored till the end notch is reached. This will allow the tool to advance at whatever rate it is cutting. When the tool cuts rapidly, the cams will slip from one to another rapidly ; whilst when the tool cuts slowly, the cams will be so much longer in slipping from one notch to another. Mr. Downie next proceeded to describe the various mechanical details necessary to secure the proper working of the machine, and explained that the invention was equally applicable to tunnelling, driving adits, sinking shafts, working upon surface of level quarries or top of cutting and level ground, working against the face of quarries or open cuttings, and to coal cutting, remarking, with reference to the latter application, that although the machine is more particularly adapted for boring hard rocks or minerals, such as the "yellow," "grey," or "peacock" ores (sulphuret of copper), and the "mundic" (arseniuret or sulphuret of iron), found, for instance, in the mines of Devonshire, Cornwall, Wexford, Portugal, and elsewhere, in nearly all copper mines throughout the world, yet it may be arranged for coal cutting on either system, and so modified that in driving "adits," or "headings," or working coals, "stoop and room," where the roof is dangerous, it will cut and trench three feet deep all round the sides by a traversing motion in addition to the percussive blows; while at the same time a central hole can be bored and widened at the bottom in the usual way, which, on being blasted, will dislocate the whole mass, and if it be objectionable to blast, as in some coal mines, the mass may be dislocated by driving wedges in the trench. In the "long-wall" system of "holeing" or "kirving" coal, the machine can be adapted to cut a continuous trench along the bottom of the seam, by which *two* successive displacements of coal can be effected, each three feet, or six feet altogether, *before* the rails need be shifted nearer to the face of the "benk" or working, and where there is a good firm roof, this must be a very obvious advantage in many respects. In addition to the above, vertical and angular cutting may also be effected by this machine, and *all* the movements made self-acting, if desired. The various advantages peculiar to these machines are self-evident.

LOW'S AIR-COMPRESSERS, to supply Compressed Air to the Boring Machine adapted for Tunnelling, consists of two compressing cylinders, fitted with air-tight pistons, packed with brass rings or cupped leathers. On each end of the cylinders are upright chambers, each fitted with inlet and delivery valves, of which there are four inlet and four delivery valves. These valves are circular, and fit air-tight down on conical faces. The four inlet valves are each fitted with a lever, working in a fulcrum, and at the end of each lever is a weight, to cause the valve to shut when the piston has drawn in sufficient air to fill the cylinders. The delivery valves shut by the back pressure, when the compressed air is all forced out of the cylinder. It was, however, found that the inlet valves did not work very steady with the levers and weights, and they also shut before the piston reached the end of the stroke. A cam, worked off crank-shaft, was adapted to each, which opens the valves at the commencement of each forward or suction-stroke, and keeps them open till the commencement of the return of the back or the compressing stroke, when they shut suddenly. The delivery valves lead to an air-vessel, in which there is constantly some water to equalize the pressure under the varying pressure of the stroke. From the two air-vessels a pipe leads the air to a receiver, or large air-vessel, constructed of wrought-iron, similar to the Butterley or egg-ended steam-boilers. These two cylinders, with their appendages, are placed at each end of a strong cast-iron bed-plate, and the pistons are worked by connecting-rods from a double disc crank, placed in the centre of the bed, and equidistant from each cylinder. The crank receives its motion from a counter-shaft (driven by two portable engines) into which it is geared by 2 pairs of spur-wheels. The cylinders are filled with water, which rises at each stroke to the top of the upright chambers, and against the delivery valve, the surplus being forced through. The object of this is to fill every space at the end of the stroke, and so force every particle of air through the delivery valves. To allow for leakage and waste of water, there is a supply kept constantly flowing into the inlet valves by a small pipe, regulated by a tap. This water slowly accumulates in the large receiver, out of which it is occasionally run out. The operation may thus be described : The disc crank revolves 27 revolutions per minute, and works the two pistons as aforesaid ; so that for each cylinder there would be 54 suctions and 54 compressions ; or for the two the total of 108 suctions and 108 compressions. At each stroke the piston draws in the air through inlet valves at the atmospheric pressure at the end of the cylinder, whilst it compresses the air to six atmospheres, or 90 lbs. per square inch, at the other, through the delivery valve to the receiver, and on the return stroke the air drawn in in the first-mentioned end of cylinder is compressed, and the air drawn in at the other. This is repeated *vice versa*. The minimum pressure maintained in the receiver is 75 lbs. per square inch, and the maximum is 125 lbs. per square inch ; the average being about 85 lbs. per square inch. From the receiver the compressed air is conveyed by cast-iron pipes with India-rubber joints up to within 50 feet of the boring machine. It is then conveyed through an India-rubber pipe with 6-ply canvas about 100 feet long. This will allow the boring machine to advance, or be drawn back, without undoing a single joint. It is usual to have only one cylinder to air compressers ; but Mr. Low finds that by having two of half-area each, the pressure of air is more uniformly delivered through the delivery valves, through the varying pressure of the stroke upon the piston, and also the strain on the working parts is more evenly divided, to say nothing of the fact that the crank is by this method balanced.

MANUFACTURE OF ZINC.—The improved process of manufacturing zinc, patented by Mr. James Webster, of Birmingham, consists in bringing the zinc ore or oxide of zinc, in a finely divided state, into the presence of molten iron, or other substance which melts at a temperature superior to the volatilising point of zinc. He adapts to a cupola a vessel containing the pulverised zinc ore, or other compound of zinc, which, together with nitrate of soda, also pulverised, is carried down a channel, and supplied in a regular manner to a close chamber, into which the molten iron is run from the cupola. This regulated supply of the zinc ore may be effected by means of a rotating screw, which will force the pulverised ore forward into the molten metal, where it will become volatilised by the high temperature to which it will be subjected in the close vessel. From this close vessel the vapours are conducted through a pipe to a vessel containing water, where the zinc vapours are condensed, and the metal precipitated. The close vessel, where the zinc ore is brought into the presence of the molten metal, will, after a time, become charged with slag, which must from time to time be drawn off. The nitrate of soda is simply to keep the slag thin; any other suitable substance may be used. As the action of the zinc on the molten iron is exceedingly beneficial, and refines and purifies the metal, and improves its quality, it may be found convenient and commercially advantageous to use the commonest description of pig-iron, in order to improve its quality.

METALLIC ALLOYS.—An improved metallic alloy, suitable for bearings and similar purposes, has been patented by Messrs. Dunlevie and Jones, of Dublin. It is prepared thus:—Take 4 ozs. of copper, melting it in any ordinary crucible; when fused add 16 ozs. of block tin and 1 oz. of antimony ; melt together and form an ingot. Then melt in a separate vessel 128 ozs. of spelter and 96 ozs. of block tin, and when both are fused add the above ingot. When properly fused in these proportions, or thereabouts, the alloy is complete. The chief features of this alloy are great durability, and its low temperature when under the heating influence of friction.

AUTIER'S PATENT.—This invention, patentee in the name of Mr. Henry, patent agent, Fleet-street, as a communication from Mademoiselle Autier, relates principally to certain new modes of dyeing, and improved mordants for the purpose. The main improvement consists in substituting tannin of the wood of oak for the oak bark hitherto employed in dyeing, and also in tanning. Sulphates of alumina, tin, and other agents are to be used in the production of mordants, together with nitric and hydro-chloric acids. Chloride liquors are to be employed in certain dyeing and preparing operations.

COURCIER'S LUBRICATING APPARATUS.—This apparatus consists of a vessel or chamber fixed over the shaft or article to be lubricated. It is plugged at top, and through the plug an air-pipe passes, the pipe being carried down into a discharge-pipe, which terminates in a very small orifice just above the shaft or other surface to which the oil or lubricating agent is supplied. The air enters in bubbles as fast as the oil is discharged, and the latter trickles very slowly through the discharge outlet, and only so long as the shaft revolves or works. When its motion ceases the supply or discharge of oil ceases likewise. The specification was filed by Mr. Henry, Fleet-street.

SOUTH WALES INSTITUTE OF ENGINEERS.

The ordinary meeting of this association was held at the Castle Hotel Assembly Room, Merthyr, on March 22. The members present were—Mr. W. Menelaus (President); Mr. R. Bedlington (Vice-President), of Rhymney; Messrs. George Martin, Dowlais; G. H. Banks, Pontymeister; Cope Pearce, Cyfarthfa; H. Huxham, Swansea; T. E. Wales, Swansea; E. Bridgen, Dowlais; C. A. Harrison, Risca; Capt. Bodmer, Newport; Messrs. G. Wilkinson, Mountain Ash; W. Child, Dowlais; Jabez Brown, Mountain Ash; Windsor Richards, Ebbw Vale, &c.

Plans, diagrams, and models, of an interesting character, were shown in the room. Mr. Hoskold's new theodolite and travelling stand excited some attention, as it will be the means of rendering material assistance to the mining engineer and surveyor. Mr. T. Forster Brown exhibited a section of strata in the Caerphilly district, commencing at the anticlinal on the north, and passing near the Rhos, Llantwit, and Van Collieries, and thence along the line of the proposed Cardiff and Caerphilly Railway, into the old red sandstone ; also a plan showing the Caerphilly mineral district. Elaborate plans were also shown of plank and cast-iron tubbing through various strata.

NEW MEMBERS.—The PRESIDENT announced that the following new members had been elected: Messrs. J. G. Jones, Blaina; D. Jones, Machen; J. Morgan, Tondu; J. Hardman, Bridgend; J. Laybourne, Newport; J. Thomas, jun., Neath; W. Brain, Cinderford; S. Carbutt, Bradford. Mr. H. L. Austin, Sheffield, was elected an associate.

The PRESIDENT thanked the members for having elected him to the chair again. He wished they had elected a gentleman with more time at his command; but as the election had fallen upon him, he should, to the best of his power, faithfully discharge the duties of the office. (Applause.) The first paper discussed was that by Mr. W. B. MONKS, of which the subjoined is an abstract:—

ON UTILISING PIT TIPS.—In some cases one of the leading difficulties with which the colliery manager has to contend arises from his ever increasing rubbish tip. The cost prevents its being carried away, and hence he is tempted to bury all the refuse he can in his working-places, and keep his mainways and airways too small for economy in working or good ventilation. It, therefore, appears to be worth considering whether it is possible to get rid of this material altogether without loss, or what is still better, to make an additional source of profit. Many experiments have been made to use it, but the only plan which promises to be attended with success is to make it into common building bricks. This idea is not new, and it is now generally understood that it will do very well for bricks, unless the quantity of small coal in it is so large as to destroy the bricks while they are being burnt. Even this may be remedied by previously burning a portion of the tip, and mixing the product with the unburnt, in as large a proportion as necessary. The tips made by working bands of iron ore in the coal measures are still better adapted for bricks, as they consist chiefly of clean shale, or still better, a mixture of that and fire-clay, and very little or no coal. But, unfortunately, in all these cases the material has first to be reduced to a coarse powder, for which a mill and motive power are required. The degree of fineness to which the material is ground has a marked effect upon the quality of the finished bricks. In order to enable bricks made from pit tips to compete, under all circumstances, with surface clay bricks, it is necessary that machinery should be employed, not only to grind the raw material, but also to mould it into bricks by a single operation. Nearly all our bricks are made by hand labour, although there is no scarcity of machines for brick making. These machines may be divided into two classes, one class being distinguished by the peculiarity that they mould a stream of clay (properly prepared) into the length and width of a brick, which has to be cut off by wires to the required thickness, while the other description of machines moulds each brick in a separate die. The latter kind of machine alone is available for making pit tips into bricks, as no practicable amount of preparation would fit fire-clay, shale, stones, ore, &c., for being cut into bricks by a wire. Perhaps the best for the purpose contemplated is "Wilson's Semi-dry Clay Brick-making machine." One of these has been at work for more than a year at Easton Colliery, Bristol. The brick-making plant there is an old winding-engine of about 35-horse power, which drives a mill for grinding, consisting of one pair of fluted and one pair of plain rolls, each being about 2 ft. long and 18 in. in diameter, in a strong cast-iron frame, and the brick-machine. The material is first ground to a coarse power, the finishing rolls being set with only about an eighth of an inch space between them, and then by means of elevators passed into the steam-trough of the brick-machine without any manual labour whatever, from whence finished bricks are delivered, ready for the kiln, requiring no more care in removing than bricks which have been dried in hacks. In this way, in a day of 10 hours, 40 tons of material is manufactured into 8000 or 9000 bricks ready for the kiln, at about the same cost for labour as would be required to grind and temper it ready for hand-moulding by the common plan of brick-making. The make at Easton is limited to under 1000 per hour, because the mill cannot grind enough material to make more; but the machine could made double that number. These bricks, by whatever process they are made, are sometimes of different colours, with black marks upon them, but these are slight advantages, and are thoroughly counter-balanced by the extra hardness and strength of the brick, and the quickness with which houses built of them get dry, enabling the walls to be plastered as soon as the building is finished. These bricks answer well for walling pits, especially where it is necessary to wall part of the pit with water-tight masonry. In the neighbourhood of Bristol there is a pit sunk 50 fms. through old workings, and walled with shale bricks, the outside of the masonry to the surface being surrounded with water. They are also useful for boiler-flues, chimneys, furnace-drifts, &c., as they will stand will when exposed to a degree of heat at which a common red brick would melt. When properly burnt, frost and rain have little or no effect upon them.

Mr. BEDLINGTON said that, for the sake of eliciting information, he should like to know if the bricks which Mr. Monks talked of were made from ironstone rubbish?——Mr. MONKS produced two specimens of bricks, one having been made that morning. They were made from coal rubbish shale, worked with a bed of fire-clay. The proportions were one-fourth of the bed immediately under the coal, one-fourth of shale, and the remainder of coal rubbish : 25s. per ton was about the selling price.

The PRESIDENT said, without wishing to pry into trade secrets, he should be glad if Mr. Monks would tell them in general terms whether the bricks could be made at a profit?——Mr. MONKS replied that they had hardly yet finished their works at Easton, near Bristol, and, therefore, he could not furnish them with accurate details of the cost derived from practical experience. He believed they would ultimately be able to produce the bricks at from 12s. to 14s. per thousand.——PRESIDENT: Then you find it necessary to mix one-fourth of fire-clay?——Mr. MONKS: We find that indispensable.——The PRESIDENT thought Mr. Monks had rendered them some valuable information, and he proposed that a vote of thanks should be accorded to him.——Mr. BEDLINGTON seconded the proposition, which was unanimously agreed to.

Capt. J. J. BODMER's paper, the abstract of which is subjoined, was next discussed:—

MANUFACTURE OF STONE-BRICKS.—The stone-bricks described in this paper are made of any clean sand (except sea sand), cinders, ground brick-bats, burnt moulding sand, ashes, or even the sweepings of gas-flues from blast-furnaces, mixed with lime. All the preparation required is sifting, which is done by machinery. At Newport the Aberthaw lime is used. The sand and lime are screened, wetted, measured, mixed, and forwarded into the press by simple mechanical contrivances, without being handled until they come forth from the press as finished bricks. The brick is taken from the press-table and put upon wheelbarrows, wheeled into the yard, and piled up, no more to be touched until it is loaded into the buyers' trucks or carts. The more changeable the weather the better, and the sooner the bricks harden. The bricks are exact in size, no shrinking taking place, and they are perfectly square and true, because they cannot warp. Of these bricks, with compact workmanship, a wall might be built so as to have the appearance of dressed stone. It is easy to produce coloured bricks; moulding sand and a little small coal produce a very dark colour; a clear sand makes a white brick; and red brick bats ground up turn out a brick of a reddish hue. Ornamental bricks, of several most useful and pleasing forms, can easily be made, and will, no doubt, become a great convenience for architects. Mr. Parry, of Ebbw Vale, at the same time as Messrs. Bodmer, were engaged in perfecting their stone-bricks, investigated the nature or possible practical application of blast-furnace cinders, and for some time the difficulty in finding the best means of disintegrating or pulverising the cinders was also the hindrance which stopped his further progress. With his well-known perseverance and rational mode of treating such questions, however, he soon found the key to the secret. He simply placed a small blast or steam-pipe behind the running cinder, and from the moment the steam or blast touched the sluggish fiery stream, the cinder was blown into snowy flakes like wool or fine hair. Mr. Parry states that blast cinders contain from 45 to 47 per cent. of soluble silica, and this fact alone sufficiently proves that those cinders heretofore thrown away as a useless material, are as valuable as trass or puzzolano, from which, mixed with ordinary lime, the Romans made their famous cements for the construction of roads, viaducts, and buildings.

The PRESIDENT said this paper, like the previous one, referred to brick-making. Mr. Bodmer gave them a still cheaper brick, as well as better in quality. He should like to know if, since the last meeting, Mr. Bodmer had made any experiments with blast-furnace slags?——Mr. BODMER replied that he had, and he found that they hardened in a much shorter time than the stone bricks. The stone bricks took generally six weeks to harden, and those from slags only a fortnight.——PRESIDENT: Do you mix any lime in the process?—Mr. BODMER: Yes, about one-eighth of mountain limestone.

The PRESIDENT said he should be glad to have some idea of the cost of manufacture.

Mr. BODMER said the labour fuel, &c., would not be more than 4s. 6d. per thousand.

PRESIDENT: That does not include interest on capital, and the depreciation of plant.

Mr. BODMER: No, 2s. per thousand would be amply sufficient for that, if the make was something like 18,000 per day.——Mr. WINDSOR RICHARDS remarked that the difficulty was to crush the cinder. They had made experiments at Ebbw Vale, and they had found the grinding rather expensive. The first experiment he tried was by making balls, and putting them in a boiler, which was driven round quickly, and they were thus crushed. He found, however, that the quantity after being ground materially decreased in bulk. The second experiment made was to crush the cinder by means of a small pair of rollers, but this also he found too costly.

The PRESIDENT remarked that it was clear that the whole question of making bricks from slags depended upon the grinding of the cinders. It was a matter of the highest importance to the iron trade, for the cinders were a source of great difficulty, and if they had only 1s. 2d. per ton for them it would be a great point for the trade.——Mr. BODMER said he had no doubt that ultimately they would be able to grind the slag fine enough at a moderate cost.——Mr. WINDOR RICHARDS said they were making further experiments at Ebbw Vale, and he also believed that the difficulty as to the grinding would be got over.

THE PORT OF CARDIFF, AND THE ABERDARE COAL FIELD.—Mr. A. BASSETT's paper on this subject was next down for discussion. The details of the paper were given in the *Mining Journal* of Oct. 29.

The PRESIDENT said he regretted to have to report that an important engagement prevented Mr. Bassett from being present. The paper was, no doubt, a valuable one, and contained a vast amount of useful information as to the Aberdare coal fields.

No discussion took place on the paper. The last paper taken was Mr. PARRY's, on the—

UTILISATION OF BLAST-FURNACE SLAGS.—The writer had many times noticed the rich character of the vegetation on the old cinder tips, and could not see why blast-furnace slags should not be used as a mineral manure. Slag contains all the necessary mineral ingredients to form the bones of plants, with the exception of phosphorus (sometimes also present), and, what is better, in an available or soluble state when mixed with the soil. Everyone has heard of the rich vineyards which clothe the sides of Mount Vesuvius, and that the peculiar richness of the soil has been attributed to the top dressing from the volcano. Now, these ashes are merely finely divided lava or slag blown out through the crater, and are of analogous composition with the slag of our furnaces; the difference being, principally, that the lava contains less lime, and in some cases more alkali, the remaining constituents may, for all practical purposes, be considered the same. The volcanic rock called puzzolano, from the neighbourhood of Naples, much used for hydraulic cement (when mixed with lime), also presents a close analogy to our slags, which may, no doubt, in some cases be substituted for it.

Mr. CHILD said he did not think the ingredients would be found sufficiently soluble to bring them to any practical use as a manure. No doubt, the slags had fertilising ingredients, such as ammonia, in them, but he questioned whether they could be used profitably. He could confirm what Mr. Parry had said as to vegetation flourishing where old furnace slags were deposited. He visited Vesuvius about two years ago, and he was surprised to find vegetation there; but, then, they must remember that the cinders were centuries old.

The PRESIDENT said that he felt that this was a matter of great importance. After he had heard Mr. Parry's paper, he had written to a friend of his, a large agriculturist in East Lothian, asking his opinion on the subject, and the reply was unfavourable to Mr. Parry's suggestions. In fact, his friend substantially confirmed Mr. Child's views; and he submitted the analysis as well to the chemist of the Highland Society, who was of the same opinion, and did not think it could be brought to practical use. He regretted to add that illness prevented Mr. Parry being present.——Mr. WINDSOR RICHARDS remarked that they had some ground with the manure in it at Ebbw Vale, and they would know the result in the summer.——This closed the discussion of papers.

NEW PAPERS.

CAERPHILLY MINERAL DISTRICT.—This was the subject of a paper by Mr. T. FORSTER BROWN, of Machen. The writer stated that, comparatively speaking, this district was quite a new field, and little known. He predicted, however, that in years to come it would become as important as the Aberdare coal field. Want of railway communication had hitherto kept the district back, but this desideratum was being gradually supplied. At the Rhos Lantwit Colliery, in this district, the Bedwas vein had been found at a depth of 155 yards. Above the coal was a hard Pennant rock, 13 yards in thickness, and the roof was, consequently, very strong. The dip of the measures was to the north, 1 in 15. The pillar and stall system had hitherto been adopted, but as the seams were favourable to machine working it might ultimately be determined to introduce coal-cutting machines, and then long wall would have to be adopted. The Lantwit was supposed to be a continuation of the Bedwas, but it was difficult to arrive at a definite conclusion, as the dislocations were so great between the two districts. The writer next showed how the following veins run, and their peculiarities:—Little Rock, Roer Brithdir, White Rock, Big Vein, Black Vein, Brass Vein, Hard Vein, and Sun. The Big Vein was an inferior quality coal to Black Vein, but it was a fair second-quality steam coal. The Black Vein was a celebrated steam coal, more especially as it stood the effects of various climates with but little deterioration. The top, however, was generally bad, and carburretted hydrogen was given off, which sometimes accumulated, and frightful explosions were the result, such as occurred at Risca a few years ago. These disadvantages rendered it difficult to make a profit on this coal. The Brass Vein was 36 yards below the Black Vein, and the large admixture of iron pyrites with it rendered the coal unsaleable. The Hard Vein and the Sun were the only remaining seams of importance to the millstone grit. There were too great faults in the district, which he described. He calculated that the Caerphilly field would be able to supply the present total output in South Wales for at least 50 years.

Mr. BEDLINGTON thought the paper a most important one, for, as Mr. Brown stated, it was on a district comparatively unknown. The only district upon which they had yet had no paper was that lying between Bridgend and Aberdare, and he should be glad if some gentleman acquainted with the locality would favour them with a paper. He moved a vote of thanks to Mr. Brown.——Mr. MARTIN seconded the proposition, which was agreed to.——The PRESIDENT said Mr. Brown had been called away suddenly, or else he would have been present. He trusted Mr. Bedlington's hint as to the district between Aberdare and Bridgend would not be forgotten.

The further discussion of the paper was adjourned to the next meeting.

TUBBING OF SHAFTS.—Mr. EDWARD HEDLEY's paper on "Tubbing of Shafts" was next read. The writer, in an elaborate treatise, showed the superiority of cast-iron tubbing over any other system. As the paper was of an entirely technical character, and made frequent reference to large plans that had been prepared, it would be difficult to give anything like a correct summary of the same. The discussion was adjourned to the next meeting.

The reading of Mr. HOSKOLD's paper "On a New Mining, Colonial, and Land Surveying Theodolite, with Travelling Stand" was adjourned to the next meeting.

The members afterwards dined together, under the presidency of Mr. MENELAUS, and the usual loyal toasts having been honoured, the CHAIRMAN proposed "Success to the Coal and Iron Trades." He alluded to the unfortunate difference at present existing between the ironmasters and the men, and observed that at present they had happily escaped that calamity; he firmly believed that for this escape they were very much, if not entirely, indebted to the good sense of the men, and also to the liberality and fairness of the masters. The masters were for the most part men of capital—men who could be called rich; and they could afford to be honest and fair to the men, and that fairness created a feeling of sympathy between the master and man; long may that feeling continue. He hoped some means would be found of healing the difficulty now existing in the North between man and master. The present one was the greatest struggle—the greatest strike they ever knew.

Mr. BANKS responded; he hoped ere long some change would be made in the refining process of iron, which at present was in an almost pre-Adamite condition. While he felt somewhat pleased at the manner in which the toast had been received, they ought not to have drunk it at all, for they were all in some way interested in the trade. He hoped at their next meeting he should be able to congratulate them on its prosperity.

Mr. BEDLINGTON, on behalf of the coal trade, responded to the proposition of the Chairman with great diffidence on account of the magnitude and importance of that branch of our mineral produce. They had been told that 80,000,000 tons of coal were produced in Great Britain, while of that large number of tons 10,000,000 were produced in the county of Glamorgan. When he considered all this, it was no wonder that he rose with great diffidence to return thanks for the coal trade. It was a trade of great importance to those who were engaged in it; it was an anxiety they had daily to pass through. They had no Father Time in their business; they had their daily cares to meet and remove. He fully endorsed the opinion that their workmen were really good men, and the manner in which they had accepted the reduction that took place a short time since showed that they were so, but the men were reasonably satisfied that the reduction was a necessity, although they sometimes found men strongly opposed to act with reason, and this method of acting often arose from a want of knowledge of the state of trade. They were ready to take an advance, but diametrically opposed to a reduction. But they had men in South Wales that were reasonably satisfied. Last autumn there was a great falling off in the price of iron. The masters hoped business would revive before long, and they allowed some time to pass by, and it was only when the reduction was found likely to last for some time that they reduced the wages of the men. The men saw that the masters behaved liberally towards them, and submitted. He could but hope, in conclusion, that none of the effects of the lock-out would be felt in South Wales. He hoped there would be peace for years to come between the masters and the men.

"The health of Mr. Wales, the Government Inspector," of "Those who Contribute Papers," and "Success to the South Wales Institute of Engineers," were subsequently given, and responded to, after which the meeting separated.

MILLWALL IRONWORKS, SHIPBUILDING, AND GRAVING DOCKS COMPANY.

The first general meeting of the shareholders was held at the London Tavern, on March 20,—Sir J. C. D. HAY, Bart., M.P., in the chair.

Mr. C. M. S. CHICHESTER (the secretary) read the notice convening the meeting.

The report of the directors stated that although the incorporation of the company dates from May 2, the directors did not enter into possession of the works until July 6; the period, therefore, to which the accounts now presented relate extends to less than six months. The directors have much pleasure in laying before the shareholders a balance-sheet, duly audited, exhibiting a nett profit upon the operations of the company during that period of 27,794*l.* 6s. 7d., and in being able consequently to recommend a dividend of 6s. per share, being at the rate of fully 12 per cent. per annum (free of income tax), leaving a surplus of 15,794*l.* 6s. 7d. to be appropriated hereafter. In reserving so large a proportion of the realised profits on this occasion, the directors by no means consider themselves to be establishing a precedent which it will be necessary to follow in future, but are actuated solely by the consideration that in the infancy of the company too much prudence cannot be manifested in dealing with its profits. The first duty which devolved upon the directors in the exercise of their functions was to take into consideration the conditions of the agreement entered into by the promoters of the company with the proprietors of the works. The price originally agreed upon for their premises, plant, and machinery was 575,000*l.*, but included in this sum were several items (among the rest a charge for goodwill) to which the directors considered themselves justified in objecting. These amounted altogether to 205,289*l.*, and after a series of negociations with the vendors, the latter were finally induced to forego this demand, and the purchase money was accordingly reduced to 369,711*l.*; this highly satisfactory result could not have been arrived at but for the large interest which the vendors retained in the concern as shareholders of the company. The considerable reduction thus effected in the original price has, in the opinion of the directors, removed the only obstacle to immediate prosperity. During the protracted negociations, the directors were deprived of several valuable members, Mr. Lubbock, the original Chairman, being of the number. The directors have endeavoured successfully to replace these losses, and have been so fortunate as to secure for the company the services of Sir John Hay, Bart., M.P., in whom the board possesses a thoroughly efficient Chairman, and likewise those of Mr. J. Lyster O'Beirne, who had been long connected with the old company. The directors had chosen as the managing director Mr. Charles Lungley, the eminent shipbuilder of Deptford, whose unquestionable ability, energy, and experience warrant the highest expectations from his successful management. The terms upon which Mr. Lungley has accepted the appointment are mutually beneficial. The directors, on behalf of the company, agree to purchase his shipbuilding yard and dry dock at Deptford at a fair valuation, without any addition for goodwill, and Mr. Lungley undertakes the management of the company's works; the remuneration for his services depends chiefly upon the amount of profits accruing. Mr. Lungley agrees to receive as the price of his yard and dry dock 30,000*l.* in cash, and the balance of the purchase money in debentures of the company, when the valuation now being made shall have been completed. Arrangements have been perfected whereby the yard at Deptford and the Millwall Works are made reciprocally co-operative to the more convenient and effective working of both establishments; and, moreover, the company have by this contract acquired one of the most spacious dry docks on the River Thames. The shipbuilding yard (which has been the principal source of profit during the past half-year) has a river frontage of 1875 feet, and is at present in fair work, having vessels upon its slips for the British, Italian, and Turkish Governments, as well as for several public companies. Among those vessels are Her Majesty's armour-clad frigate "Northumberland," of 6621 tons burthen; and the armour-clad cupola frigate the "Affondatore," of 2306 tons, for the Italian Government. The foundry and engineer's shop, the latter chiefly occupied by the manufacture of engines for the various vessels in construction, are of capacity to turn out engines of from 1200 to 1500-horse power. The massive and much-admired columns of the London, Chatham, and Dover Railway-bridge, at Blackfriars, as well as the beautiful castings which adorn that structure, are productions of the company's foundry. The forge and smithy are furnished with steam-hammers, varying from 2 to 7 tons, and are capable of producing the largest shaftings in use. The enormous "forgings" required for the stem and stern of the "Northumberland" have been made in this department. The bridge department is adapted to undertake work of the most extensive character. Several bridges on the line

of the London, Chatham, and Dover Railway; the foundation cylinders, 18 feet in diameter, of the Blackfriars-bridge, above alluded to; and also the tube for the Middle Level Main Drainage Works, passing over the Metropolitan Railway at Clerkenwell, 150 feet in length and 9 feet in diameter, are among the works completed in this latter department. The mills department consists of the boiler-plate mill, which is capable of turning out 130 tons per week of plates for shipbuilding and other purposes, up to 2 tons in weight each. The bar mill can roll angle bars up to 50 feet in length. In this mill is rolled the excellent gun iron for which large orders have been and are now being executed for Her Majesty's Government and Sir William Armstrong. The armour-plate mill has already rolled bars 15 in. thick, and can roll armour-plates to any required size. The large bars, 18 in. square, used in the construction of the target made for the Russian Government were rolled in this mill; likewise the whole of the armour-plates for the "Northumberland," the Italian frigate "Affondatore," the "Bellerophon," and many for the "Royal Sovereign," and others of Her Majesty's ships. The armour-plates produced from the mill have obtained from the Government the highest order of merit—superior A 1—a standard which has been but seldom reached by other establishments, while the numerous targets and experimental batteries so successfully constructed at the works are well known to the public. The whole of this department, which has only recently been brought into a state of complete efficiency, will, the directors have every reason to believe, prove highly remunerative to the company. The directors, in view of the large expenditure incurred for the supply of gas (for which above 1800*l.* has been paid in one year), have caused the erection upon the company's own premises of adequate apparatus, by which the whole of the gas consumed in lighting the works will be manufactured at one-half the former cost of the article.

The CHAIRMAN, in moving the adoption of the report, said that, considering the very short time which the company had been at work, the result achieved could not but be regarded as of a very favourable character. The company had been embodied barely three-quarters of a year, and at work about only six months, yet in that short time there had been a realised profit of 27,794*l.*—a result, considering the great difficulties of the past half-year, the difficulties of trade, and other difficulties under which they had laboured, that must be exceedingly gratifying to those who were fortunate enough to hold shares in this company. He had no doubt the shareholders would agree with the directors in thinking that it would have been undesirable to have declared a larger dividend than that recommended upon the present occasion. It must be remembered that the whole of the capital was not yet called up, and the directors thought if would be undesirable to call up any portion just at present, but until they saw what the future profits were likely to be the directors were of opinion it would be imprudent to pay a dividend larger than that recommended. He wished to call particular attention to that portion of the report which referred to the great advantage that had arisen in consequence of the change in the nature of the bargain which the company made when they acquired possession of the works. It was originally intended that 575,000*l.* should be paid for the works, and the profit derived during the half-year tended to show that it was not such an extravagant valuation for them. At the same time there was an agreement that a guarantee of 8 per cent. should be given for two years, but the directors thought it would be better to have the same reduced, and instead of the guaranteed 8-per cent. they now offered the shareholders 12 per cent. (Hear, hear.) Considerable change had taken place in the management of the company, and with the greatest respect to the former management, he must say that he thought the company had obtained a great acquisition in having Mr. Langley, who was now a director, for their manager, for he did not hesitate to say that the profitable working of the concern for the last six months was almost entirely owing to that gentleman. His great energy and knowledge, with the way in which he succeeded in working profitably with a smaller number of hands, all tended to show that they had made a very good bargain when they obtained the co-operation of Mr. Langley. At the same time, in obtaining his (Mr. Langley) valuable services they had obtained what they had not before, and what they would have been obliged to make—an excellent yard. Mr. Langley's yard was now under process of valuation, and the company would obtain possession of it without any payment for goodwill, but solely for the actual value of the plant. That yard contained the largest dock in the river, and its possession would be of the greatest advantage to the Millwall Company, and there was no doubt that that, together with the Britannia Dock, would be of considerable benefit to the company. As the shareholders were aware, there had been some discussion in Parliament with respect to the delay that had taken place in the contruction of the "Northumberland." For that delay this company were in no way responsible, and the Admiralty were quite satisfied that since the company had had charge of the works the vessel had been proceeded with as rapidly and as well as could be desired. In some respects the delay would prove advantageous to the public service, because it had been discovered by the Admiralty authorities that the lines of the three sister ships, the "Northumberland," the "Agincourt," and the "Minotawr" were defective. In consequence of the advanced stage of the "Agincourt" and the "Minotawr" that defect could not now be remedied, but it had been in the "Northumberland;" and it would be a very great gratification to the company to know that in consequence of a delay, which was none of their making, they would be able to produce one of the very finest ships in the navy. He then proposed that the report should be received and adopted.—Mr. HEMING seconded the motion, which was put and carried unanimously.

A resolution was then passed declaring a dividend of 6s. per share, payable on March 31.

Upon the proposition that Messrs. Quilter, Ball, and Co. should be appointed auditors, which was moved by Mr. ALDERSON,—Mr. J. BALSTER enquired whether there was a second auditor?—The CHAIRMAN replied that the board had not thought it necessary, but at the same time, if the shareholders desired it, the directors would interpose no difficulty in the way of the election of another auditor.—Mr. BALSTER did not wish to make any change if it were not thought necessary.—The motion was put and carried unanimously.

The meeting was then made special, for the purpose of altering a clause in the Articles of Association, restricting the amount of any interim dividend declared by the directors to 5 per cent. A resolution for that purpose having been agreed to, a vote of thanks was passed to the Chairman and directors for the ability and energy with which they had managed the affairs of the company.

The CHAIRMAN, in acknowledging the compliment, said he had never seen a board which worked more cordially together, or were more anxious to promote the interests of the shareholders. (Hear, hear.)—The meeting then separated.

THE MINERAL RESOURCES OF MEXICO.

It has been predicted that when Mexico could offer security to European colonists no production of the new empire would offer greater attraction to the foreigner, or be likely to yield a larger revenue, than the silver mines. It has been not unreasonably asked—If, when worked with slave power by the Spaniards these mines yielded enormously, why should they not be as profitably now, when we have satisfactorily proved that free labour is cheaper than slave labour? We know well that no system was adopted by the Spaniards in working the mines of any of their colonies in America; and if, with their rude machinery and want of mining lore, they could make the mines of Mexico remunerate them so handsomely, it will be hard indeed if English miners, with their superior knowledge (and such will, undoubtedly, flock thither if only security be offered them by the new Government), cannot do as well as the old Spaniards. Again, every miner knows that the cost of working silver ore depends immensely on the price of mercury, as placed at his mines. What great advantages, then, does Mexico possess in this respect, adjoining, as she does, California, where such immense deposits of cinnabar have of late been discovered? Modern improvements have, it is true, much diminished the loss of mercury, required in amalgamating silver ores, but the necessary loss of mercury by the most careful processes forms a most serious item in the cost of extracting silver from its ores. It is estimated that the silver mines of Mexico alone are capable of yielding no less than 4,000,000*l.* of the precious metal annually, so that it is only reasonable to suppose that the development of mines so enormously productive cannot be carried on without yielding very satisfactory interest upon the capital employed.

Among the Mexican mining properties to which the attention of British capitalists has recently been called may be mentioned the mines about to be worked by the San Pedro del Monte Silver Mining Company, the lodes in which are considered to be the continuation of those in the great Tlalpujahua Mine, one of the richest in the world, and which yielded its fortunate proprietor silver to the value of no less than seven millions sterling in three years. The opinion of Capt. John Eastwick, who was for several years employed by the Real del Monte Company, and who has carefully examined the property, is that it is one of the best speculations he has ever seen in the country, well worthy the attention of any enterprising party of mining capitalists. These remarks more especially refer to the Santa Rita lode, but Capt. Eastwick appears to be equally pleased with the appearance of the San Pedro, the other principal lode in the property, and 5 varas wide. He states that the walls of these lodes are very solid, and will need but little timber to secure the ground. Wherever timber may be required there is no difficulty in obtaining it, as the mine is completely surrounded by very large pine timber; consequently the expense of procuring it for the use of the mine will be small indeed. From a higher part of the mountain in which the mines are situated an abundant and constant supply of water for the drainage of the mine can be obtained at a trifling expenditure, thus rendering the cost of a steam-engine unnecessary. Mr. W. Chynoweth reports that as the ores are of a rich class it will be advantageous to erect some smelting-furnaces forthwith, and others when required, and also reduction works on the amalgamation principle, having first a good stock of ore to begin with. Particular attention is directed to the important fact of the junction of the veins occurring under the most favourable circumstances, as they already produce good ores in their separate state, and such occurrences generally result in producing large and continuous quantities of rich ore. He concludes that it would be presumptuous to attempt to make an exact calculation of the produce that may be realised from working the property, but he is fully convinced that these mines will become some of the richest silver-producing concerns in the New World, and it should be borne in mind that the grand feature in the undertaking is that rich silver ores may be extracted from the mines immediately, and without any considerable outlay being required.

It is universally considered that it is the political condition of Mexico alone that has prevented the development of its mineral resources, for, as it is very justly remarked, that if the new emperor be capable of amalgamating the opposing interests of the Indian, Spanish, and mixed races, whether by political tact or by the aid of arms borne by foreign mercenaries, Mexico must rapidly advance, since she possesses sources of national greatness which hardly any European kingdom can boast of. Her frontier stretches from the Atlantic to the Pacific, and we may describe her whole area as one vast mountain. The Cordillera rises abruptly from the sea and forms a series of table lands; and, as the traveller enters Mexico from the south, the Cordillera branches east and west, and almost skirts the coast on either side. In the space between the mountains and the shore is the Sierra Caliente, with its burning heat and tropical vegetation. Advancing inland, the climate changes to the perpetual spring of the Sierras Templadas, which lie on the slope of the Cordillera, and reach a height of 5000 ft. Advancing northwards still, and crossing a rocky sierra, you enter the valley of Mexico, and find yourself in the Sierras Frias, or cold regions; a little further north of which are the districts of the silver mines, in the midst of a fertile country of maize. This last is the spot whence the coffers of Spain were filled in days of yore, and which may now, probably, again be the source of silver to Europe and the world.

GAS IN LONDON—No. I.

We propose to give a few details as to the thirteen great gas companies of London,—the Chartered, City of London, Commercial, Equitable, Great Central, Imperial, Independent, London, Phœnix, Ratcliff, South Metropolitan, Surrey Consumers', and Western. The annexed statement shows the paid-up share capital of these important concerns at the close of 1863, 1862, and 1861:—

Company.	1861.	1862.	1863.
Chartered	£719,460	£720,000	£720,000
City of London	364,000	364,060	330,000
Commercial	289,239	322,195	350,411
Equitable	240,000	252,000	268,000
Great Central	172,160	185,400	185,400
Imperial	1,072,500	1,170,000	1,170,000
Independent	120,000	120,000	120,000
London	518,290	518,387	518,672
Phœnix	540,000	540,000	540,000
Ratcliff	90,000	90,000	90,000
South Metropolitan	163,526	196,884	200,000
Surrey Consumers'	149,394	150,000	150,000
Western	216,463	230,000	244,429
Total	£4,655,632	£4,858,866	£4,936,912

The share capital of the companies was thus increased in 1862 and 1863 to the extent of 281,280*l.* Further, capital had been raised by debentures as follows at the close of each of the three years under review:—

Company.	1861.	1862.	1863.
Chartered	—	—	—
City of London	£ 43,805	£ 50,795	£ 51,795
Commercial	41,300	22,100	7,500
Equitable	40,400	27,900	12,000
Great Central	66,000	66,000	66,000
Imperial	124,000	125,300	284,300
Independent	30,000	30,000	30,000
London	100,930	98,130	102,530
Phœnix	—	—	—
Ratcliff	9,097	5,097	4,448
South Metropolitan	—	—	—
Surrey Consumers'	34,900	34,300	34,000
Western	49,328	49,644	49,744
Total	£539,760	£509,266	£642,817

The debenture capital of the companies was thus increased in 1862 and 1863 to the extent of 102,057*l.* Further, profits had been capitalised as follows at the close of the three years:—

Company.	1861.	1862.	1863.
Chartered	—	—	—
City of London	—	—	—
Commercial	—	—	—
Equitable	—	—	—
Great Central	—	—	—
Imperial	£338,403	£338,403	—
Independent	36,782	37,382	37,382
London	32,472	32,269	30,978
Phœnix	—	—	—
Ratcliff	—	—	—
South Metropolitan	—	—	—
Surrey Consumers'	—	—	—
Western	—	—	—
Total	£107,657	£408,054	£68,360

It will be seen that the debenture capital was considerably increased in 1863, a circumstance due to the issue by the Imperial of 10 per cent. proprietors' bonds (authorised by 17 Vic., cap. 55) to the amount of 130,000*l.* On the other hand, the sum of 338,403*l.*, which had figured in the capital of the Imperial as capitalised profits, disappeared from the accounts for 1863. This company, it should be added, had received in anticipation of calls 44,853*l.* at the close of 1861, 25,630*l.* at the close of 1862, and 25,630*l.* at the close of 1863. The aggregate amount raised by the companies at the close of the three years was, therefore, as follows:—

	1861.	1862.	1863.
Shares	£4,655,632	£4,858,866	£4,936,912
Debentures	539,760	590,266	642,817
Profits capitalised	407,657	408,054	68,360
Anticipation of calls	44,853	25,630	25,630
Total	£5,647,902	£5,801,816	£5,673,719

The total addition to capital in one form or another in 1862 and 1863 would thus appear to have not exceeded 25,817*l.* The capital raised by each of the companies at the close of the three years, either from shares, debentures, capitalisation of profits, or anticipation of calls, was—

Company.	1861.	1862.	1863.
Chartered	£719,460	£720,000	£720,000
City of London	407,805	414,795	431,795
Commercial	330,539	344,295	357,911
Equitable	280,400	279,900	280,000
Great Central	238,160	251,400	251,400
Imperial	1,579,755	1,659,333	1,480,430
Independent	186,782	187,382	187,382
London	651,692	648,786	652,180
Phœnix	540,000	540,000	540,000
Ratcliff	90,097	95,097	94,448
South Metropolitan	163,526	196,884	200,000
Surrey Consumers'	184,894	184,300	195,268
Western	265,791	279,644	294,173

Comparing 1863 with 1861, we thus find that the capital of the Chartered was increased to the extent of 540*l.*; that of the City of London, to the extent of 23,990*l.*; that of the Commercial, to the extent of 27,372*l.*; that of the Great Central, to the extent of 13,240*l.*; that of the Independent, to the extent of 600*l.*; that of the London, to the extent of 488*l.*; that of the Ratcliff, to the extent of 4351*l.*; that of the South Metropolitan, to the extent of 36,474*l.*; that of the Surrey Consumers', to the extent of 10,374*l.*; and that of the Western, to the extent of 28,382*l.* The capital of the Phœnix remained without variation. That of the Equitable was decreased to the extent of 4000*l.*; and that of the Imperial by 99,325*l.* So much for capital. In a future article we shall sketch the return received on the sum—about five millions and three quarters—which is engaged in supplying gas to this great metropolis.

The oldest of the companies to which we have been directing attention is the Chartered, the first Act relating to that undertaking being the 50 Geo. III., cap. 163. The City of London, the Commercial, the Equitable, the Great Central, the London, the South Metropolitan, the Surrey Consumers', and the Western, have been commenced, we believe, during the reign of Her present Majesty.

ASSOCIATION FOR THE PREVENTION OF STEAM-BOILER EXPLOSIONS.—The last monthly meeting of the committee was held at the offices, Corporation-street, Manchester, on Tuesday; Mr. William Fairbairn, president, in the chair; when Mr. L. E. Fletcher, chief engineer, presented his report, of which the following is an abstract:—During the last three months 559 engines have been examined, and 803 boilers, 39 of the latter being examined specially, and 6 of them tested with hydraulic pressure. Of the boiler examinations, 621 have been external, 150 internal, and 32 thorough or entire. In the boilers examined 326 defects have been discovered, 12 of them being dangerous. In three cases of injury to furnace crowns the injury in each instance arose from over-heating at night time, in consequence of shortness of water when the fires were banked up. The first of these occurred to a plain two-flued "Lancashire" boiler, which was one of a series of four, and the water was lost through the blow-out valve at the bottom of the boiler. The valve was of the sluice or slide construction, which is an objectionable one, inasmuch as there is an uncertainty as to its being closed. The second case occurred to one of double furnace "breeches" construction, set in a series of three, two of them being at work at the time, and all of them connected together, both by the steam and feed pipes. The third case occurred in a plain, single-flued "Cornish" boiler, the water being lost through the feed back-pressure valve, which was found to have been kept off its seat by some dirt. Each of the injured furnace crowns in these three cases was fitted with a fusible plug fixed near to the fire-bridge, and which proved useless in every instance. It would appear advisable to place fusible plugs rather over the centre of the fire than at the bridge, so that they might be more sensitive to the effect of a local and smouldering fire, though their action is not always sure, even when the flames play directly underneath them. Low-water safety-valves are much more reliable, and would have proved of valuable service. A plug of a different design has lately been introduced from abroad, where it appears to be in general use, though it is but little known here. It is placed outside the boiler, and seated at the top of a vertical pipe some three or four feet high, which is carried through the shell of the boiler, and down to low-water line. On the water sinking in the boiler below the desired level, the bottom of the pipe becomes uncovered, the cold water falls out of the tube, and the hot steam takes its place, when the fusible plug at once melts, and allows the hot steam to escape and blow an alarm whistle. Eleven steam-boiler explosions have occurred, by which six persons were killed, and twenty-four others injured. Not one of the boilers was under the inspection of this Association. In addition to these, an explosion occurred to a household boiler, by which one person was very seriously injured. The boiler in the latter case was employed for the purpose of warming the water in a cistern on a floor above it, and was fixed immediately behind the fire-grate of a kitchen range, by which it was heated. To prevent the recurrence of these explosions, all such boilers should be fitted with a small ordinary metal safety-valve, which would not be affected by changes of temperature, and were this done the water would escape at these valves and relieve the pressure when the pipes were choked with ice. An illustration of the importance of equipping boilers with suitable mountings occurred on January 9 to a portable agricultural boiler of the locomotive multitubular type. It was one that was let out for hire upon different farms for driving threshing-machines, and steam was being got up in it for this purpose, as it was standing alongside the barn, when the explosion happened. The owner of the boiler attributed the explosion to the lessee having worked it at too high a pressure (of which he considered that the flight of the man-hole cover was sufficient evidence), and threatened an action at law. The injudicious construction of the fire-box casing, which was weakened by the man-hole is, however, sufficient to account for the explosion. In another explosion, a piece of plate, having a superficial area of about five square feet, was torn out of the side of the boiler, right through the solid metal, and shot away by the force of the steam, while the boiler remained in its place unmoved, and in other respects intact. The explosion occurred at an ironworks, to a boiler which was one of six that, though situated at different parts of the works, were yet connected together, both by steam and feed pipes. It was heated by the flames passing off from two puddling-furnaces, and from one fire-grate. There seems little reason to doubt that the rent was caused by the plates being over-heated, owing to the water being driven away from the plates by the rapid ebullition of steam within the boiler, caused by furious firing, and the too local impingement of the flames upon a vertical surface, combined with the use of sludgy water. This is only another illustration of the dangerous character of these externally-fired upright-furnace boilers.

FOREIGN MINING AND METALLURGY.

The great Parisian company for Lighting and Heating by Gas effects every day more and more progress. Thus, in 1864 the consumption of the gas produced by the company was 109,608,000 cubic metres of gas (a metre is 40 in. English). This total was an augmentation of 8,776,000 cubic metres (or 8·70 per cent.) over the consumption of the preceding year. Every day a fresh advance is effected in the manufacture of gas, and the production becomes both more abundant and more economical. Contracts entered into with the communes of Joinville, St. Maur, Vanves, Bagnolet, &c., will come into force as soon as the prefectoral authorisation has been received. At St. Dizier transactions continue quiet; the demand is dull, and is limited to daily wants. It cannot be said that transactions have wholly stopped; sales are effected, but not on a sufficient scale. Some years since a movement of affairs like that which now prevails would have appeared very satisfactory, but with the development now given to means of production, and the absence of a proportionate extension of orders, sales are effected with a certain difficulty, and the trade cannot utilise all the resources of activity which it has at its disposal. It results from this that forgemasters must either reduce their production, work for warehousing, or render the situation still more stagnant and sluggish by offers which the *clientele* of the district accepts all the more slowly in proportion as they are more pressing. Rolled irons are dealt in at 8*l.* 12s. and 8*l.* 16s. per ton on provincial account, while hammered irons are quoted at 10*l.* 4s. and 10*l.* 12s. per ton. Machine iron is in little demand; its price remains at 9*l.* and 9*l.* 4s. per ton for No. 20. Founding industry complains also of a want of activity in sales; some works have been obliged to reduce their tariffs about 5 per cent. in order to obtain business.

We read in a Charleroi letter:—"The grave incidents which have led to the closing in England of many ironworks have hardened our market by raising the probability of a revival in siderurgical affairs. Forgemasters expect this revival, and not without reason, for during the last few days orders have reached them from London for iron and plates, which they owe, without doubt, to the difficulties with which English metallurgy now finds itself struggling, and of which it is difficult to foresee the end, when one reflects on the obstinacy of English workmen, and the assistance which they receive in analogous circumstances. In any case, the cessation of operations in many English works must necessarily, by diminishing production, raise prices. It is known that the price of Belgian iron fell recently in consequence of the fall which had occurred in England. The fact must be recalled that the revival which occurred last year on our market was occasioned by a circumstance of the same kind—a strike of English puddlers. This year, as in 1864, English houses have contracts for iron, plates, and rails for America, the Baltic, and other districts; and in order to assure their execution they will, doubtless, pass to us a part of their orders. With regard to coal, workers who had hesitated to follow the upward movement which has prevailed of late now see how unfounded were their fears. Prices are accepted by merchants without difficulty; sales are made freely, and it may be foreseen that our collieries will have no stock when the period of great winter supplies sets in." On the whole, there is not much change to note in the situation of metallurgical industry. Pig is very well held. As regards iron, the current of orders is very insufficient. We announced some weeks since the conclusion of a contract for rails for Spain, which was obtained by an English house, and we stated, we believe, that Belgian industrials, on entering into the competition, carried their prices 4s. per ton above their competitors. This fact, which is of very little importance, has given rise to a discussion between metallurgists and shippers. The forgemasters contend that the contract was lost in consequence of the high freight from Antwerp to Lisbon, to which an Antwerp journal replies that there is nothing excessive in freights, and if the market has failed the fault rests with producers.

A recent report made by the Belgian Consul in Spain contains some interesting information on the coal trade in the Peninsula. The Consul says:—"It is not to the default of the means of transport that our coal mining industry, which has suffered greatly from a diminution of outlets, must attribute the absence of relations with Spain. If she does not export into that country it is only because coal delivered at Antwerp costs dearer than English coal delivered in the ports of Cardiff, Newport, Swansea, and Newcastle-on-Tyne. It often happens that by reason of this fact ships which go on a voyage to Spain leave Antwerp in ballast to take a cargo of combustible in one of the English ports which I have just mentioned. French coal being completely rejected from the Peninsular market, and indigenous products not being utilised from the want of means of communication, or by by reason of their bad quality, English coal almost alone supplies the manufactories of Catalonia. It is the same with the coal of Wales, which is more highly esteemed than that of Sunderland, Newcastle, and Hartlepool, and which is generally employed for the service of steam boilers and forges."

Chilian copper remains in favour at Havre at 84*l.* per ton. At Hamburg, in consequence of the more favourable advices from England, the demand has been better, but it has not been possible to execute several orders, the prices fixed being too low. At Amsterdam, Drontheim has made 57 fls.; Swedish, 55 fls.; and North American, 53½ fls. At Rotterdam, Drontheim has also made 57 fls. At Havre, Chilian and Peruvian, in bars, have made 84*l.*; Peruvian mineral (pure standard), 83*l.*; United States (Baltimore), 92*l.*; ditto, Lake Superior, 94*l.* to 101*l.*; Mexican and Plata, in bars, 76*l.*; Russian, 94*l.* to 98*l.*; old yellow copper, 54*l.* to 60*l.*; red ditto, 83*l.* to 84*l.*; bronze, 70*l.* to 76*l.* At Antwerp, American has made 108*l.* At Paris, English in plates has made 88*l.*; tough cake ditto, 88*l.*; Chilian, 84*l.*; and Corocoro mineral, 86*l.* There has been no favourable change in the tone of the tin market; the quotations at Rotterdam indicate more feebleness, a lot of 500 blocks of Banca having been dealt in at 56½ fls., and a lot of 400 blocks at 57 fls. At Amsterdam, Banca has made 57 fls. At Paris, Banca has made 101*l.*; and Detroit, 90*l.* to 91*l.* At Havre, Banca has made 95*l.*; Detroit, 90*l.* to 91*l.*; Peruvian, 76*l.* to 84*l.*; and Peruvian mineral, 40*l.* to 48*l.* Lead continues to be neglected, in consequence of the less favourable advices received from England. At Rotterdam, Stolberg has made 11 fls., and German, 10¾ fls. At Paris, Spanish saumons have made 22*l.* 10s.; French, 20*l.* to 20*l.* 16s.; Belgian, 21*l.* 12s. to 21*l.* 14s.; and rolled, 22*l.* 8s. per ton The situation has not sensibly changed as regards zinc. At Paris rough Silesian has made 21*l.* 16s.; rolled, 23*l.* 4s.; and Vieille Montagne, 28*l.* per ton. At Havre, zinc has made 20*l.* 8s.

The annual report of the Bank of Belgium states several facts of interest in connection with metallurgical, &c., enterprises with which the bank is mixed up. The balance-sheet of the Ougrée Ironworks Company, presented to the general meeting of the shareholders, June 28, 1864, indicated for the year ending the previous April 30 a nett profit of 2532*l.*, after deducting an important sum for various redemptions. A sum of 1872*l.* was carried from the account of reserved interest due by the establishment to the foresight account. The current account of this company, the situation of which continues to be satisfactory, presented Dec. 31, 1864, a balance at the debit of 62,546*l.* which was 2034*l.* below the corresponding total, Dec. 31, 1863. The report of the bank proceeds:—"We referred in our last report to the transformation which the Herve Company must undergo, a transformation which was then proposed in provisional conventions. These conventions have been since definitively agreed on, and they have received the consecration of the Royal Decrees required for their validity. The new Herve-Wergifosse Company, the existence of which has been carried retrosectively to Jan. 1, 1864, has realised in the course of the year profits which will enable it to distribute to the shareholders, after redemption of all expenses incident to the new combination, and an attribution of 10 per cent. to the reserve a sum of 1*l.* 6s. per share. The result is all the more satisfactory, as the Herve-Wergifosse Company has not touched any revenue from the shares which it possesses in the Société de la Minerie, the profits referring to these shares having been left by it to the Société de la Minerie to form the fourth of the floating capital and reserve in this company. The creditors of the Herve Company have engaged, in order to facilitate the arrangement which has been adopted to give a discharge of their claims in consideration of the transfer to them of five old shares against one new share. The creditors will thus receive 800 of the 1000 shares, which are in the fusion between the companies of Herve and Wergifosse, the part of the Herve Company. The exchange of the old titles against the new shares was only commenced Dec. 31 last, and no account has been taken in the balance-sheet of this partial operation, nor of the dividends which are acquired to the shares; the debt of the bank has been maintained in its entirety. It will be replaced at the end of the exercise by a number of shares corresponding to the share of the bank in the whole of the debts. The shares which are not presented for exchange, and there can be very few of these, will remain burdened with a proportionate share in the debts. The balance at the debit of the Société de Charbonnages et Hauts Fourneaux de l'Esperance amounted on Dec. 31, 1864, to 47,250*l.*, presenting a diminution of 3317*l.*, as compared with the balance of the preceding year. In order to assure in a more regular manner its financial service, the Société de l'Esperance has consolidated in some degree a part of its debts by creating obligations for 24,000*l.*, 40*l.* each, producing 5 per cent. interest annually, and repayable in the following manner:—4000*l.*, Oct. 1, 1867; 8000*l.*, Oct. 1, 1868; and 12,000*l.* Oct. 1, 1869. The bank has accepted these obligations, and has carried the amount of them to the credit of the company's account. The Société de l'Esperance has continued during the course of the exercise which has just elapsed to largely improve its different services. Its collieries were not at the commencement of last year in a state to produce the quantities of coal which might be expected from them. The different seats of extraction were thus able to give satisfactory results only in the course of the second half-year. The considerable diminution in the return price, resulting from the augmentation in the production, has shown that there is in the collieries of the company an important source of profit, and that it may be hoped that none of the regrettable accidents of the last few exercises will occur to interrupt its development. The blast-furnaces and the iron manufactory were last year the object of important ameliorations, the influence of which must make itself felt in the future. The balance-sheet of the exercise 1863 showed a loss of 9962*l.* Notwithstanding the burthens imposed

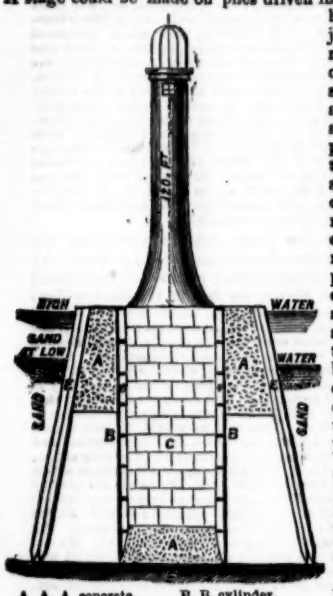
on the company by dear interest, and notwithstanding preparatory works with which the return price has been charged, the company realised in 1864 profits more than sufficient to make good the loss sustained in the former year."

CYLINDER FOUNDATIONS.

TO THE EDITOR OF THE MINING JOURNAL.

SIR,—Since my last letter appeared in the Journal, efforts have been made in the *Times* by Mr. John Hughes, M.I.C.E., supported by Sir C. FOX, in order to induce the public to believe that the invention of cylinders for the formation of coffer-dams for submarine foundations was the "happy invention" of the said Mr. Hughes. It is remarkably singular that my invention, published in the *Mining Journal* in 1847—the plans of the proposed cylinder foundations exhibited in 1848 in the very institution that Mr. Hughes belongs to, and gets the annual report of its proceedings—that four years after (in 1852) Mr. Hughes should have hit upon this "happy invention" of adopting the cylinders proposed by me, and absolutely get the praise of it as his invention. Mr. Hughes must have been excessively modest in 1852 in not saying anything about his supposed invention; perhaps, it was not convenient—any noise then would have brought out the real inventor, who would have plucked Mr. Hughes of his borrowed honours. But for the information of Mr. Hughes, I will now give the readers of the Journal a *verbatim* copy of that part of my letter which refers to my invention, with the exact wood-cuts as they appeared in the Journal of November 27, 1847:—

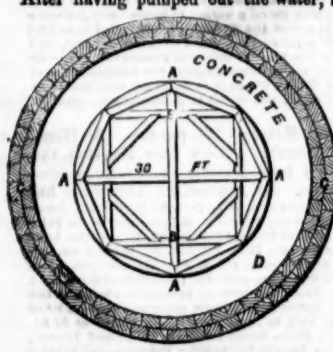
"From many enquiries I have made respecting the depth of the Goodwin Sands, I believe these sands are not more than 60 ft. thick—at that depth is the chalk formation. If we can by any means get to the chalk, we have at once a foundation for a lighthouse, which would resist every storm. I propose to construct a wrought-iron cylinder—say, ½-inch boiler-plate iron—of 30 ft. diameter; this would give a sufficient base for a lighthouse of 120 feet above high-water mark; such a lighthouse would be seen at a suitable distance. The cylinder could be made in sections of 4 ft. in length; these should be fitted up on shore with the greatest care. A stage could be made on piles driven into the sand, and the whole well braced together. Having adjusted the preliminary arrangements, the first 16 feet of the cylinder could be put together, suspended between four lighters, and then by the aid of a small steamer towed into its intended position, and then lowered into the sands. Having fixed and secured the first portion of the cylinder to low-water mark, the remaining sections of the cylinder could be floated off in the same manner. The joints having been previously prepared, each section could be screwed together, and sunk to the required depth. I should resort to Dr. Potts's system of atmospheric pile-driving, by which means the cylinder could be forced down to the required depth. The next operation would be to drive the external piles, as shown in the diagram.



A, A, A, concrete. B, B, cylinder.
C, stone work, inside the cylinder.
E, E, double rows of piles, for the protection of the cylinder.
F, chalk formation.
e, e, wood planking inserted between the flanges, to reduce the friction in sinking the cylinder.

The piles should also be driven by Dr. Potts's system, and the whole well braced together. The pile driving being completed, the sand between the cylinder and the piles, A, A, should be taken out as deep as possible, with the bag and spoon apparatus; the space thus excavated should be immediately re-filled with the best concrete; this would entirely protect the foundation against every storm. The cylinder being so far secured, a few ship-pumps could be fixed inside the cylinder to pump out the water; and, in order then to secure the cylinder against external pressure, a process of timbering should be resorted to, as shown in the diagram annexed.

After having pumped out the water, and well secured the cylinder against the external pressure, the sand inside the cylinder could be taken out, and the same process of timbering repeated every 5 feet, until the whole of the sand is excavated to the chalk formation. The concrete foundation for the lighthouse should then be put in without delay, as shown in A, *Fig.* 1. The concrete being set in one mass, the stonework, C, could be commenced; and as the stonework rises inside the cylinder the timber would be taken out. The stonework should be of the strongest construction, and every block well bound together.



A, the cylinder.—B, timbering, to secure the cylinder against external pressure.
C, double rows of piles, to protect the cylinder and concrete.
D, space between the piles and cylinder, to be filled in with concrete.

All works of this character should be commenced early in the spring. While the apparatus should be all on the shore in readiness, the cylinder should be sunk into its position as quickly as possible, and secured by the piles and concrete. This plan of effecting a firm foundation is not only applicable to the Goodwin Sands, but can be extended to similar structures.

I now ask both Sir C. Fox and Mr. Hughes, M.I.C.E., what part of the cylinder foundations was invented by the latter? Mr. Hughes states he is not a patentee, and, therefore, has no exclusive rights to support, "except those of reputation." Sir, although I am the inventor of the "cylinder foundations," I have no patent for the invention. But the cylinder foundation is my invention, and I will do my best to prevent either Sir C. Fox or Mr. Hughes depriving me of the honour of my invention, which, without doubt, for enabling engineers to construct submarine foundations is one of the greatest inventions of the age. I now throw down the gauntlet to Mr. Hughes, and desire to know from him what part of the cylinder foundations he claims as his invention; and, further, if in 1848 he did not see my plans for effecting submarine foundations on the walls of the Institution of Civil Engineers?

GEORGE SHEPHERD, C.E.

26, *Throgmorton-street.*

PRICES OF MATERIALS,

As charged at GREAT WHEAL VOR MINES during the following months:—

Description.		Oct.	Nov.	Dec.
Coals, common	per ton	12s. 6d.	12s. 6d.	12s. 6d.
Coals, Cardiff	„	18s.4d.–20s.	18s.4d.–20s.	18 4
Iron, common	per cwt.	9 6	—	10 0
Iron, best	„	11 6	12 0	12 0
Steel, cast and blister	„	45 0	45 0	45 0
Nails, patent 5 and 6 in.	„	20 0	20 0	20 0
Tallow	„	—	44 6	45 6
Grease	„	26 0	—	26 0
Oil, Gallipoli	per gal.	—	—	5 9
Candles	per doz.	5 5	5 5	5 5
Hilts, pick	per doz.	1 9	1 9	2 0
Powder	per 100 lbs.	40 0	40 0	40 0
Cartridges	per 100	38s.–52s.	38s.–52s.	38s.–52s.
Leather, bend	per lb.	—	2 4	2 4
Leather, butt	„	2 0	2 0	—
White yarn	„	0 6	0 6	0 6
Hemp	„	0 5½	0 5½	—
Timber, Norway	per foot	0 8½	0 8½	0 8½
„ pine	„	1s.3½d.–1s.4d.	1 4	1s.3½d.–1s.4d.
„ oak	„	3 3	—	—
Rope	per cwt.	48 0	48 0	48 0
Stamp-heads, longshanks	„	—	2 0	—
Chain	„	—	28 0	27 0

THAMES TUNNEL COMPANY.—Receipts for the week ending March 25, 88*l.* 11*s.*, 3*d.*; number of passengers, 21,255.

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